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Studying at university: Early perceptions and experiences of first year service mathematics students

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Abstract

It is well known that studying at university for the first time can be problematic for both recent school leavers and mature-aged students. The present study investigated students' behaviours, expectations and perceptions of university study within the context of a first-year service mathematics subject. The study investigated the perceptions of both on-campus and distance education students using a mixed methodology of surveys, and structured and unstructured interviews. The findings indicate that on-campus students spend significantly less time studying than distance education students, with both groups studying fewer hours than expected by curriculum designers. Further, although students clearly reported the characteristics that they believed defined an effective student, on questioning, few displayed the characteristics in their study practices and few accessed or had the skills to access the available support offered. The implications for academic staff and curriculum designers are briefly discussed, along with the study's relevance to the students' experience in the first year of university.

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Introduction

There is little doubt that few universities have escaped the influences and pressures produced by the move from elite to mass higher education. One of the results of this is that it is generally accepted that the first year at university can be problematic for many students (McInnis, 2001; Byrne & Flood, 2005). In Australia, in a series of snap-shot studies on the first-year experience between 1995 and 2005, Krause, Hartley, James, and McInnis (2005) report on numerous issues facing first-year undergraduate students. Further, in a survey of 1563 full-time Australian students, McInnis and Hartley (2002) found that 40% agreed that their paid work got in the way of their academic studies and 63% claimed that they were often overwhelmed by all they had to do. Long, Ferrier, and Heagney (2006) report that stage of life is an important factor for retention in first year, finding that students with full-time jobs had difficulty managing competing demands while young students generally withdrew because they needed a break or wanted a change of direction. In this climate of change, Lawrence (2002) believes that pivotal to a student's success is the use of specific socio-cultural competencies, such as seeking help, participating in a team, making social contact, seeking and

giving feedback, expressing disagreement and refusing a request. Lawrence's view is reinforced by academic staff who believe that students' level of preparedness, motivation and abilities to manage tertiary study are significant determinants of success in higher education (Author & Bedford, 2004).

Although issues related to student success, retention and performance have been topics of research internationally for some time (e.g., Tinto, 1993; Yorke, 1999; Krause et al., 2005), the area is still contentious. Factors affecting retention have recently been reviewed by Pascarella and Terenzini (2005) and summarised by Zeegers (2004), McKenzie, Gow, and Schweitzer (2004), and Watson, Cavallaro, and Austin (2004). These findings show that factors were diverse and included both personal and contextual factors such as, prior achievement, campus climate, organisational constructs, psychological attributes, student knowledge about subject offerings and academic factors. Although, prior academic achievement is consistently an important determinant of success (Robbins, Lauver, Le, Davis, & Langley, 2004; Zeegers, 2004; McKenzie et al.) other factors can also be influential. In a meta-analysis of 109 studies Robbins et al. (2004) found that when psychosocial and study skills were considered, there was a moderate relationship between retention and academic self-efficacy and academic-related skills associated with self-regulation, while the best predictor of Grade Point Average (GPA) was academic self-efficacy and achievement motivation.

Further an added complexity to understanding of the first-year experience is the predicament of first-year service subjects, particularly the mathematics service subjects. Such mathematics subjects are expected to address the needs of students immersed in diverse disciplines, from different educational backgrounds and with a diversity of beliefs and attitudes towards mathematics. The prevalence of this type of diversity within commencing engineering and science students studying mathematics has been widely reported previously (e.g., Author & Morgan, 1999; Otung, 2001; MacGillivray & Cuthbert, 2003; Heck & van Gastel, 2006; Wilson & MacGillivray, 2007), but is now compounded by the necessity not only to teach students content but also to develop their tertiary learning skills (Author & Mander, 2003). Anecdotal evidence over a period of time suggests that students are not necessarily studying as lecturers and curriculum designers would expect them to. Within this context, the present study aims to investigate students' study and learning behaviours, along with their expectations and perceptions of university study. This study reports on both on-campus and distance students.

Background

Students involved in this study were all enrolled in Foundation Mathematics, a core subject within Engineering and Surveying (55% of 711 students), Sciences (9%) and Information Technology (20%) award programs at the University of Southern Queensland (USQ), Australia. The subject is a precursor to the traditional first-year calculus/algebra subject required by all Bachelor of Engineering students and repeats and reinforces many of the topics covered in Australian senior school mathematics, including introductory calculus. The curriculum design and delivery of the subject have been described in detail by Author and Mander (2002).

The enrolments in the subject are characterised by an extremely diverse mix of students, indicated by variables such as age (55% under 20 years, 45% mature aged), mathematical background (3% junior maths, 20% general senior maths, 77% senior maths with calculus), time away from study (43% recent school leavers, 57% between 2 and 40 years since previous study), attitudes and beliefs about

studying mathematics (34% enjoy maths, 44% do not enjoy it, 22% have no opinion) and mode of study (49% study on-campus, 51% by distance education). The majority of students (82%) studying by distance education were in paid employment while studying, while 40% of on-campus students were in paid employment, averaging 12 hours per week.

Method

Questionnaire

An extensive student questionnaire was developed for the present study, consisting of 115 items grouped into 32 questions. The questionnaire focussed on ascertaining students' perceptions of university procedures, knowledge about support services, beliefs about themselves as learners along with their expectations about university study and life. Some questionnaire items were selected from existing questionnaires (Kantanis, 2000). Other items were developed specifically for this study as part of wider research on learning at university. One hundred and forty-eight on-campus students (63% of group) completed the questionnaire in tutorial classes and 63 distance education students (18% of group) completed mailed surveys. Both groups completed the surveys in the eighth week of study, allowing them time to engage with university study and life.

Interviews

Follow-up interviews were conducted face-to-face or by phone with a sample of 20 students selected randomly from specified groups. Interviewees came from both distance education and on-campus student groups in equal numbers and from Engineering, Sciences and Information Technology disciplines. Males outnumbered females in a ratio of 4:1 in the sample (a reflection of the gender ratio in the subject). Students were both mature-aged (12 students) and recent school leavers (8 students) and had achieved a range of university entrance scores. The interviews had unstructured and structured components. The unstructured component was designed to put the interviewees at ease and to encourage them to freely express views about their early experiences at university. The structured component was designed to prompt students' beliefs about the value of the questionnaire and their specific reaction to mathematics and the mathematics subject. Not all components of the interview are reported in this paper.

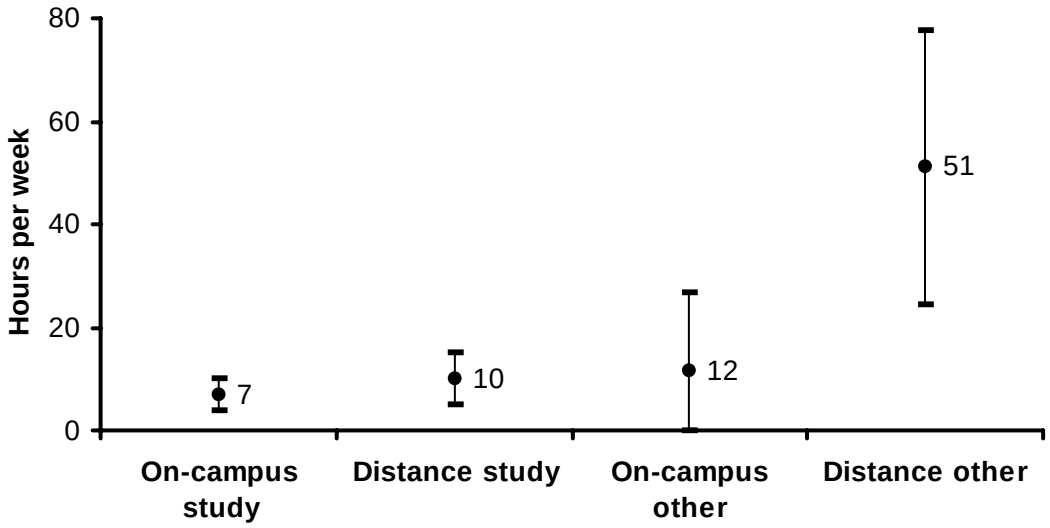
The interview transcripts were analysed for specific themes using an interpretive form of thematic analysis following Ezzy (2002). A theme was identified as a general topic occurring within the interview transcripts, initially identified through simple inspection of each transcript. A method of thematic analysis coding (Ezzy, 2002), utilising NVivo computer software (Richards, 1999), was then used to code the data that were interpreted as belonging to one or more themes. The analysis focused on the whole sample of interviews rather than on individual transcripts. Key themes were identified if they occurred at least once in 75% of the interview transcripts. Other themes of interest were identified arbitrarily as themes or subsets of the key themes.

Results of questionnaire

Time spent on study and non-study activities

Within the sample of on-campus students, 90% studied the equivalent of 4 subjects during the sampled semester while 76% of distance education students studied 1 or 2 subjects in that semester. This is the recommended pattern of enrolment for the two modes of study and close to full study load (4 for on-campus students, 2 for distance education). On-campus and distance education students under these study regimes would be expected by subject designers to spend approximately 11 hours each week in study activities (classes, assessments and/or private study) for a single subject in a 15-week semester. The actual time spent studying in week eight was considerably less than anticipated and was different for on-campus and distance education students. On-campus students would spend at least 4 hours per week in classes. Fifty percent of on-campus students spent 7 hours or less studying per week (median), with only 9% of students studying 11 hours or more per week. For distance education students fifty percent of student studied for 9 hours or less per week, with 38% of students studying 11 or more hours per week. Figure 1 shows the mean times students from each group spent on study per subject and other activities. The mean study times were similar to the median times with on-campus students studying significantly less time than distance education students ($t_{205} = 20.8$, $P < 0.001$). In both cases the mean time spent studying was less than the recommended time of 11 hours per week. However, the high standard deviations evident for the distance education sample and the skewed nature of the distribution of times (38% greater than 11 more hours per week) indicates that some distance education students were spending considerably longer than these 11 hours.

Figure 1. Mean (± standard deviation) hours per week spent in study and other (paid or community work) activities for students studying on-campus or by distance education



Students' self-assessment of skills for study

In the questionnaire students were asked to reflect firstly on the study characteristics they believed made a successful student and then to indicate which of the study characteristics they possessed personally. Percentages of on-campus ($n = 148$) and distance education students ($n = 63$) who agreed (or strongly agreed) that effective students should have the listed study characteristics (ideal) or that they actually possessed the listed characteristics (actual) are presented in Table I. The characteristics that most students (80% or more) believed were essential for effective study included:

- attends all specified lectures/tutorials
- reads all study materials
- takes a responsible attitude to their study
- asks questions or for help/advice at an early stage
- is well organised
- is strongly motivated to succeed.

Interestingly, these were also the characteristics that showed the greatest mismatch between desired and actual characteristics (greater than 20 percentage points difference).

Fifty to sixty percent of students believed that a good knowledge of university procedures, level of educational preparation, and family/peer support were the characteristics of an effective student. With the exception of the presence of family and peer support, only 30–40% of students indicated that they actually possessed these characteristics. In the case of peer/family support, approximately 70% of students agreed that they possessed such support for their study.

Characteristics of effective students that are often believed by teachers or reported in the literature to be important for success at university were not rated highly by either on-campus or distance education students (40% or less). These characteristics included possessing natural intelligence, having good luck, good health, financial security, having knowledge of university structures, and studying long hours.

Table 1. Percentage of on-campus (n = 148) and distance education students (n = 63) who agreed or strongly agreed that effective students should have the listed study characteristics (ideal) or that they possessed the listed study characteristics (actual)

Characteristic of effective student	On-campus			Distance		
	Ideal	Actual	Diff	Ideal	Actual	Diff
Takes a responsible attitude to their study	94	59	35	98	64	34
Is strongly motivated to succeed	88	62	26	88	74	14
Reads all study materials	86	42	44	89	84	5
Is well organised	84	33	51	92	47	45
Attends all specified lectures/tutorials	83	86	–3	67	41	26
Asks questions or for help/advice at an early stage	76	30	46	80	39	41
Has specified goals and refreshes them regularly	67	36	31	75	44	31
Communicates well with fellow students	62	61	1	53	42	11
Has family/peer support for university study	59	72	–13	68	69	–1
Is well prepared educationally for university study	58	44	14	53	40	13
Has good knowledge of university procedures	48	31	17	42	23	19
Has good health	44	60	–16	45	67	–22
Has good knowledge of university structure	41	31	10	32	23	9
Studies long hours	34	22	12	22	34	–12
Has financial security	33	35	–2	31	48	–17
Possesses natural intelligence	32	44	–12	30	37	–7
Has good luck	12	17	–5	3	9	–6

The questionnaire asked students to indicate their level of expertise at a range of specific study skills (see Table 2). In the majority of instances the percentage of distance education students who believed they did not possess the designated skill(s) was higher than that of on-campus students. This was especially the case for team work skills, in which 38% of distance education students were concerned about their skill compared with only 15% of on-campus students. The percentage of distance education students concerned about team work matches the percentage concerned about online discussion groups, the medium through which team work is conducted for distance education. It is interesting to note that percentages of on-campus students concerned about using online discussion or chat groups for learning was unexpectedly high at 52%.

Fifty percent of on-campus students indicated that they were not skilled in giving oral presentations, while 28% and 38% of on-campus and distance education students respectively had few skills in preparing a study timetable.

Table 2. Percentage of on-campus (n = 148) and distance education students (n = 63) who believed that they possess either no skills or below average skills in the designated tasks

Specific study skill	On-campus	Distance
Using electronic discussion or chat groups	52	41
Talking unprepared in front of a tutorial class	49	NR
Giving a prepared oral presentation in a tutorial situation	38	NR
Creating study or revision timetables	28	38
Preparing written descriptions of mathematical or scientific situations	23	36
Using the library	23	36
Taking notes at lectures	21	NR
Writing reports, essays or other longer writing tasks	19	20
Making notes from study materials	18	20
Working in groups or teams in tutorials or in electronic discussion groups	15	38
Reading university-level material (e.g. text books, study materials)	12	11
Using a computer	9	5
Using a calculator	4	8

NR—not relevant for distance education students

Strategies for requesting assistance

Students were asked to indicate their preference for seeking assistance from the lecturer or tutor and from support services. The majority of responses from on-campus students indicated that they were most likely to ask a question in a tutorial or before or after the lecture or tutorial, rather than in the lecture (82% never or rarely did this). Between 35% to 43% of on-campus students in the sample indicated that they would never approach a lecturer personally, either by phone or directly in person in their office. Eighty-three percent of distance education students in the sample were most likely to contact their lecturer by email, while 73% indicated they would use the distance education contact service (OUTREACH), 62% would use the electronic discussion group and 54% phone.

In terms of specialised support services on-campus and distance education students were mostly likely to contact the library help services (68% and 50% respectively) and least likely to contact Student Services (counselling, 32% and 29% respectively). Thirty-six percent and 50% of on-campus students were likely to contact academic learning advisors and computer help services respectively (48% and 46% for distance education students).

Results of interviews

Four key themes were identified in the interviews. The first was related to students' perceptions about mathematics in general, the second related to their own mathematics background, the third to the questionnaire, and the fourth to general study skills. Table 3 details the summary of specific themes and sub-themes, along with illustrative quotations from interview transcripts. Students' reactions to the questionnaire will not be reported in this paper.

Table 3. Summary of interview themes

Themes and sub-themes	Number of students	Number of quotations	Examples of student comments
1. Perceptions of Mathematics as a subject	20 (100%)	117	
Materials	17	27	I find the maths here really good because they show you how to do all the steps one by one. In school, the teachers just do a few steps on the board, and if you got behind, you got behind and it was harder to catch up. With this, you can look at it, over and over again.
Subject structure	15	54	It's not as stressful as the other subjects, cause you don't feel as pressured to do it all the time.
Tutors	16	21	She comes around when we're working and asks how we're going. If we have a problem we just ask. It's pretty easy, and she said we can come and see her whenever we want.
Assignment	5	6	It made me realise how much stuffs actually due, and when they're due, and how busy it is.
Online quizzes (CMA)	4	6	I found the CMAs, were really good.
2. Study Skills	17 (85%)	62	
Time management	15	36	Need more time, not help
Learning materials	2	2	Go through the book and do all the questions, that's what I do
Learning style	7	16	Tend to prefer to go to lectures. I tend to learn by osmosis. If I go and I listen, and then I go home and I write out my notes, then I learn a lot better.
Assignments	2	2	I found it was not busy at the start, and then there was heaps just after Easter, I had 4 assignments due within that 2 week period, and I found that I was up late nights.
Getting help	7	10	I didn't know where to go, who to go to. And they sort of seemed really distant.
Motivation	4	10	Yes, I've got a lot of big essays in other subjects. I've even started 3,000 word assignments early, just to avoid doing maths.
3. Maths Background	15 (75%)	23	
Beliefs	12	18	Found it hard but still enjoyed it. I've never been able to do it, my family can, but not me
Content	6	6	I did Maths B at school, I've forgotten some of it with time off but it's coming back to me.
Time since study	1	1	Haven't done maths for several years.

What did students think about the mathematics subject?

In this major theme, 5 sub-themes were identified of which only 3 were spoken about by more than 75% of the students interviewed. Seventeen students spoke about the subject materials while 15 commented on the subject structure, usually in a positive way. Sixteen students made comments specifically about tutors or the tutorials.

Interestingly, although the majority of these students indicated that they would feel comfortable approaching tutors for help, very few had actually done it. They stated that their resistance was not due to fear of approaching the tutor but rather because of their belief that they should really be able to work it out by themselves. There was a sense that asking questions was not the "done thing" and that they would look foolish by doing so. They also did not feel confident to contact the tutor privately.

What did students think about their mathematics background?

Only 15 of the 20 students mentioned their maths background, with 12 of these making comments about the beliefs about themselves or mathematics.

> Steep learning curve as it is different to what I've done before. I've cleaned out the cupboards before I've done maths. I've done ironing!

> Well, I like maths when you apply it to a problem. But not so much on its own, where it's just maths and you learn maths.

What did students think about study skills?

Fifteen students talked about study skills with all of them referring to issues related to time management.

> Work. I've got 2 jobs, and to keep up with everything … I coach gymnastics, which takes up a bit of time. And I work at a service station at week-ends and sometimes during the week.

Seven students mentioned issues related to their learning style.

> I find a lot of it, there's certainly calculations and that, most of it is rote learning. 'Here's a list of facts, learn them.' 'These are the nutrients needed by these plants. Learn them' I learn better like that. Make up jingles with the first letters of all the things. That's how I learn, rather than maths is a completely different subject, I guess, to these other ones that I do.

> Yeah, about the groups that you can learn in. I find it easier to learn in groups. And if you can work with other people on the same problems, it's more interesting to do the maths. Sometimes, by the teacher it can get pretty boring, but with other people there, you're more involved and easy to socialise.

Discussion

It is widely believed and reported that students' experiences in the first semester of first year of university study are an integral part of the decision a student takes to stay, to perform, or to leave university. Lowe and Cook (2003) say:

> When students fail to make a satisfactory transition to the new academic and social demands of university life, the results are manifested in drop-out and under achievement. (p. 1)

Research discussed previously suggests that this successful transition is related to students' study and learning characteristics, self-efficacy and academic-related skills and motivation. This investigation into selected student activities and perceptions clarifies the nature of some of these characteristics, behaviours and beliefs.

Students in this study understood well what was required to be an effective student. They placed a high priority on engaging with study activities such as attending lectures, reading appropriate material and asking questions early. Yet in the early weeks few students actually carried forward these ideals into actual practice. Their practice certainly did not match what curriculum designers had recommended should take place. Hours spent participating in study-related activities (classes, private study or assessment) are not necessarily related to success at university (Kember & Ng, 1996; Kember, 2004), yet, academic staff have the expectation that students will need to spend some time reading, reviewing and performing other study activities. At USQ, the expectation of the curriculum designers is that students will spend on average 165 hours doing these activities each semester (11 hours per week). In actuality, and corresponding to the findings of Byrne and Flood (2005) in Ireland, most students in this study spent considerably less than that, with on-campus students spending significantly less time than students studying by distance education. These disparities could be interpreted in numerous ways. Perhaps academic staff have unrealistic expectations about the time that is required to study their subjects or the level of difficulty of their subjects. Alternatively, perhaps students had not yet realised the need to be fully involved in their studies. The survey was undertaken in week 8 of the semester, the half way point, when most students had completed at least one assignment. The fact that the younger on-campus students (usually recent school leavers) spend less time than distance education students (usually mature aged) might seem to suggest an early adjustment problem for the recent school leavers, or a lack of engagement with university learning. Ditcher and Tetley (1999) and Dolnicar (2005) report an increasing tendency for on-campus students not to participate in lectures. Alternatively the proximity of school-based education may mean that they believed that increased number of hours studying was not necessary.

A complicating factor in students' transition to university is the increasing tendency for students to be in paid employment while studying. The high frequency with which students mentioned their concern about managing their time between study and work, may mean that some transition difficulties may partially lie there. Today more and more students are working, including full-time on-campus students as well as part-time distance education students. The Australian Vice Chancellor Committee (AVCC, 2007) study of students' finances reports that

> 39.9 per cent of full-time students and 54.1 per cent of part-time students surveyed believed that the paid work they were doing had an adverse effect on their studies. (p. 1)

The conflicting pressures or the inability to manage the pressures of work, study and life activities can lead to students not spending enough time at their study. AVCC (2007) found that 23% of full-time students and 33% of part-time students regularly skipped classes because they needed to work. Interestingly, distance and mature students consistently cited more time spent on study. So although working full-time, most of these students are studying proportionately longer hours than on-campus students. Although not explicitly investigated in this study it is not unrealistic to relate this to higher levels of motivation often attributed to mature students (Leder & Forgasz, 2004; McGivney, 1996).

This reduced use of study time may have serious consequences for students. McKenzie et al. (2004) details that students who report a greater use of effective learning strategies (manage their time, regulate the amount of effort expended on tasks, monitor their comprehension, draw connections between readings and lecture material and organise their subject material) will achieve higher grades than students who do not practise such behaviours. Killen (1994) noted that students, however, were more likely than lecturers to attribute success to factors that were perceived to be beyond their control. Students in this study acknowledged the importance of McKenzie's factors through their identification of the characteristics of effective students, yet 40% of those students who indicated that such factors were important did not actually implement the associated strategy, e.g., manage their time or ask for timely help. Why this is the case is unclear and was not addressed in this study. Yet it could be hypothesised that it is related either to their understanding of the skills, their ability to use these skills or the lack of time to implement them. In many instances it is assumed that students will come to university having acquired appropriate learning skills at school or at work. It is apparent from this study that although they know about the skills, they have difficulty mobilising them.

One skill that is of particular interest is help-seeking behaviour. In line with the belief that the transition to university study is problematic, a vast array of support services is provided to students along with traditional academic assistance provided by lecturers and tutors. Yet despite the efforts of academic staff and extensive advertising by the support providers, students indicate that they do not take advantage of this type of assistance. Students acknowledge the importance of such assistance and included asking for help early as one of the characteristics of an effective student, yet 40% of both on-campus and distance students did not access help provided. Numbers of students in the sample accessing non-faculty help services were also small. Students did not clearly articulate their reasons for not asking for help, but the possibilities are numerous. For example students may not have the ability to recognise that they are not coping or may lack strategies as to how to ask for help. Alternatively perhaps staff and support providers are not deemed approachable by students. Clegg, Bradley, and Smith (2006) in a study of help-seeking behaviour in university students reported that it is related to situated self-esteem and proper and measured judgements about the self and the ability to cope. They considered ways in which institutional support might strengthen students' resources, rather than undermine them through therapeutic approaches to support. Lawrence (2002) believes that we should pay particular attention to help-seeking competencies in the design of learning experiences and proposes that they are one of the key competencies for success at university that is rarely realised by either staff or students. The results of this study indicate that clearly help-seeking behaviours are not well understood in the context of learning and teaching.

As indicated in the introduction the context of a service mathematics course presents further complexities. Certainly, situations within service maths courses have been reported to be problematic due to the diversity of student backgrounds and perceived motivations to study mathematics out of context (Taylor & Mander, 2003). However, in this study the issues that are most outstanding are the ones associated with the affective domain. Interviews revealed, not surprisingly, that a number of students had high levels of mathematics anxiety. These students indicated that it was not uncommon for them to avoid studying mathematics in preference to other courses or other activities. Such behaviours have been widely reported in the literature over many years (e.g., Hembree, 1990; Balogˇlu & Koça, 2006). One aspect that is relevant to the current study is Zettle and Houghton's (1998) work on the belief that maths anxiety is socially unacceptable to male students. As the population investigated was predominantly male, the presence of mathematics anxiety combined with a reticence to ask for help could be problematic for their first year of study.

Conclusion

This study aimed to clarify students' perceptions and expectations of themselves as learners within the first semester of their study at university. As such it has clarified and confirmed a number of anecdotal beliefs about students. It is clear that most students know the characteristics of effective students. What is not clear is their ability to mobilise their own knowledge and skills to implement what they believe will be effective. The confounding factor in this is the increasing necessity of students in all modes to participate in paid work and its effects on their study time and skills development. Further, the presence and visibility of significant amounts of stand-alone support does not appear to be enough to support students in these early weeks of study. Students do not take up the offers of support for reasons hypothesised to be related to situated self esteem and self knowledge, as well as the help-seeking environment. Clearly help-seeking behaviours and help-seeking environments are as yet poorly understood.

It is apparent that if academic staff and curriculum designers want to engage students to fully participate in university study from an early stage, they will need to address teaching approaches and activities, as well as assessment and curriculum design that explicitly address the need for students to develop self-regulatory and help-seeking behaviours. In particular students will need to not only be given explicit "permission" to ask for help but the personal skills with which to do this.

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